Union of So. Africa

#29

#29

UNION OF SOUTH AFRICA

DEPARTMENT OF COMMERCE AND INDUSTRIES

DIVISION OF FISHERIES

INVESTIGATIONAL REPORT No. 29

THE SOUTH AFRICAN PILCHARD

(Sardinops ocellata)

AND MAASBANKER

(Trachurus trachurus)

YOUNG FISH SURVEY, 1955-56

MAR 1956
LIBRARY
POFI
FISH & WILDLIFE
SERVICE

BY

D. H. DAVIES, M.Sc., Ph.D.

(Senior Professional Officer, Division of Fisheries, now *Institute of Marine Resources*, University of California.)

THE GOVERNMENT PRINTER, PRETORIA.

1957

G.P.-S.1831433—1957-8—1,200.

Reprint from "Commerce & Industry". OCTOBER, 1957

DEPARTMENT OF COMMERCE AND INDUSTRIES

THE SOUTH AFRICAN PILCHARD
(Sardinops ocellata)
AND MAASBANKER
(Trachurus trachurus)

YOUNG FISH SURVEY, 1955-56

BY

D. H. DAVIES, M.Sc., Ph.D.
(Senior Professional Officer, Division of Fisheries, now *Institute of Marine Resources*, University of California.)

INVESTIGATIONAL REPORT No. 29

Issued by the Division of Fisheries, Beach Road, Sea Point, Cape Town

Union of South Africa

Digitized by the Internet Archive
in 2025

https://archive.org/details/investigational-report-sfri-za_1957_29

Contents.

Page.

1. Summary 4

2. Introduction 5

3. Method 5

4. Distribution and abundance of juvenile fish—
   (*a*) In relation to area and season 9
   (*b*) In relation to temperature 11
   (*c*) In relation to wind 12
   (*d*) In relation to plankton 12

5. Composition of the catches of juvenile fish—
   (*a*) Pilchards 13
   (*b*) Maasbankers 13
   (*c*) Others 14

6. General Discussion 14

7. Acknowledgements 14

8. References 14

I. Summary.

In this report the results of the first year of the young fish survey by means of a blanket-net are discussed. Although the first year of the survey has been to some extent exploratory, interesting results were obtained. Modification of the present arrangement of stations in order to provide better coverage has been made for the second year and it is evident that the blanket-net survey will be an invaluable addition to the Pilchard/Maasbanker Research Programme.

As a result of working the blanket-net regularly once a month for a period of a year at each of eleven stations situated off the west coast of South Africa, the following findings were made:—

(1) The blanket-net has proved far more successful than any method previously used by this Division for the collection of juvenile fishes.

(2) Juvenile *pilchards* occurred in smallest numbers off the West coast in winter; they increased rapidly in abundance in spring, reached a maximum in summer and their numbers declined again in autumn.

(3) Juvenile *pilchards* were found mainly in the central area* in the vicinity of Saldanha Bay in winter and were widely dispersed in the area between Cape Deseada and Table Bay in spring and summer. Largest concentrations were found in the northern area in summer and in the south in autumn.

(4) Juvenile *maasbankers* occurred in smallest numbers off the West coast in summer; their numbers increased in autumn but declined again in winter. A rapid increase in numbers was recorded and produced maximum abundance in spring.

(5) Juvenile *maasbankers* were widely distributed in the area between Lambert's Bay and Table Bay during summer. In autumn their distribution was similar to that which occurred in summer except that greater concentrations occurred in the central area. In winter young maasbankers were found in the northern and central areas only but in spring they were again recorded in all three areas.

(6) Juvenile *anchovies* occurred in smallest numbers off the West coast in winter; their numbers increased rapidly to reach a maximum in spring and then declined in summer and autumn.

(7) Juvenile *anchovies* were confined to the central area in winter; in spring they were present in the central and southern areas and in summer they were recorded in all three areas. In autumn they were widely distributed in the central and northern areas.

(8) Juvenile *round herring* occurred in smallest numbers off the West coast in winter; they increased in abundance in spring, reached a maximum in summer and their numbers declined in autumn.

(9) Juvenile *round herring* were recorded in the three areas off the West coast in all seasons except winter. In winter they were present in Saldanha Bay only.

(10) Off the West coast in general, but excluding Saldanha Bay, the maximum occurrence of juvenile *pilchards* coincided with the minimum temperatures recorded during the summer months. The maximum occurrence of *maasbankers* coincided with the higher temperatures recorded in spring.

(11) It is apparent that a relationship exists between the abundance of juvenile *pilchards* and wind. When juvenile pilchards are most abundant in spring and summer, southerly winds are most prevalent. In autumn and winter when southerly winds are far less frequent, juvenile pilchards are present in smallest numbers.

(12) There is no apparent relationship between the occurrence of juvenile *maasbankers* and wind.

(13) The seasonal variation in the abundance of juvenile *pilchards* shows a direct relationship with the seasonal variation in abundance of edible plankton as shown by settled volumes.

* Southern area = Table Bay to Dassen Island.
Central area = Saldanha Bay to Cape Columbine.
Northern area = Stompneus to Lamberts' Bay.

(14) There is no apparent relationship between the occurrence of juvenile *maasbankers* and edible plankton.

(15) The possible rate of growth of juvenile *pilchards* of standard lengths 3–8 cm is 0·8 cm per month.

(16) The possible rate of growth of juvenile *maasbankers* of standard lengths 3–15 cm is 1·25 cm per month.

2. Introduction.

This paper is one of a series dealing with the South African Pilchard, *Sardinops ocellata* and Maasbanker, *Trachurus trachurus* and is the first report in the series which deals with the juveniles of these and associated species.

From the start of the Research Programme in 1950 the location and sampling of juvenile pilchards and maasbankers was considered to be important. Attempts at collecting and sampling young fish by various means such as N200 plankton tow-nets, scoop-nets and traps used over the ship's side at night in conjunction with an attraction light and small mesh beach seine nets met with little success. Later, explosive charges consisting of sticks of commercial gelignite were used in sheltered waters in daylight from a small vessel. Although this method brought in more samples than any other it was far from satisfactory due to the fact that the majority of fish killed by the explosion immediately sank to the bottom. Where the bottom was suitable, the fish could be retrieved by means of a dredge-net but where there was rocky bottom the majority were lost. This method was haphazard and at times dangerous. Identification of shoals of young fish was frequently made by shooting predatory birds in the act of feeding and subsequent examination of their stomach contents, but satisfactory sampling by this method was naturally not possible.

During 1955 it was decided to construct and try out on board R.S. *Africana II* a blanket-net on the lines described by Radovich and Gibbs (1954).

The net was duly made up and after an experimental cruise in July, 1955, a regular young fish survey cruise using the blanket-net was started in August, 1955, and was continued for a period of one year. The results obtained have been encouraging and much has been learned from the first year's work. Due to the fact that several modifications were made after the completion of the first year's survey it was thought advisable to present the results obtained for the first year without waiting for further data.

The ultimate object of this juvenile fish survey is to make an assessment of each year class at a stage before it enters the fishery and, because the survey is carried out on a quantitative basis, to provide and estimate in advance of the total size of each class when it enters the fishery. It should therefore provide an estimate of the rate of recruitment to the commercially fished population based on data obtained a relatively short time before the fish enter the commercial fishery and therefore at a time when the fish are subject to a smaller degree of natural mortality.

While the achievement of the ultimate object will take time, useful information regarding juvenile pilchards, maasbankers and other young fish found in the area has been obtained from this initial survey and the study of the general biology of these two species has been materially advanced.

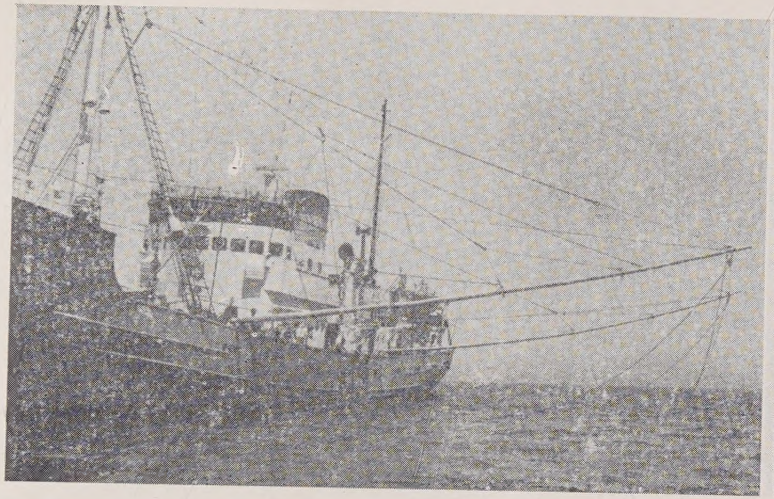
3. Method.

A blanket-net was constructed similar to the first net described by Radovich and Gibbs (1954), but the $\frac{3}{4}$ in. cotton twine mesh was replaced by number 6 thread, $\frac{1}{2}$ in. mesh netting. The net was rigged on R.S. *Africana II* on two gum (eucalyptus) poles, 55 feet in length (see figure 1).

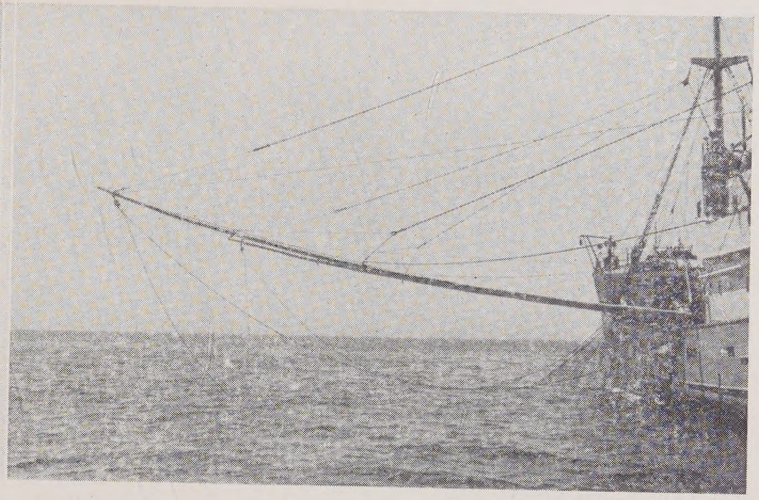
The light source used was a 500-watt spotlight mounted on the rail of the flying bridge and directed towards a position in the centre of the net when in the hauled position. The spotlight was found to be more satisfactory than a light suspended over the net as it could be more easily controlled and did not get splashed.

The operation of the blanket-net was carried out in the same manner as that so adequately described and figured by Radovich and Gibbs (1954).

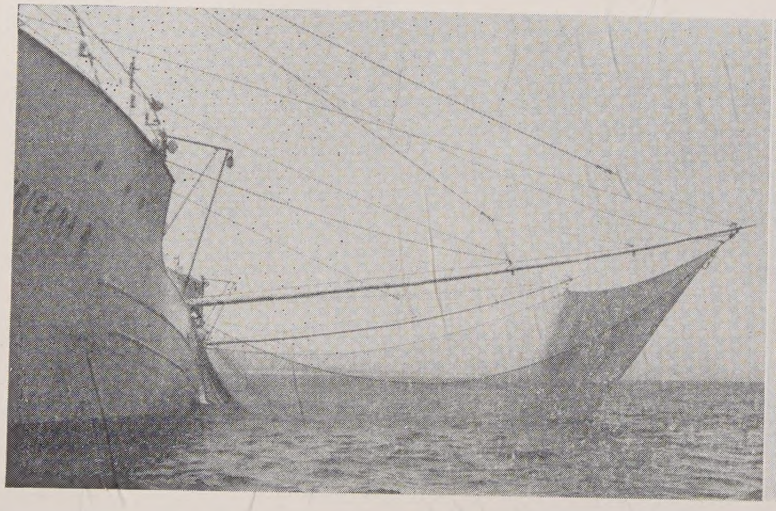
From earlier attempts at collecting *juvenile pilchards and maasbankers* by means of lure lights, scoop-nets, explosives, the shooting of predatory sea-birds, etc., from 1950 onwards, it was evident that *these young fish were to be found mainly close inshore and in sheltered waters such as bays; they were never encountered far out to sea.*



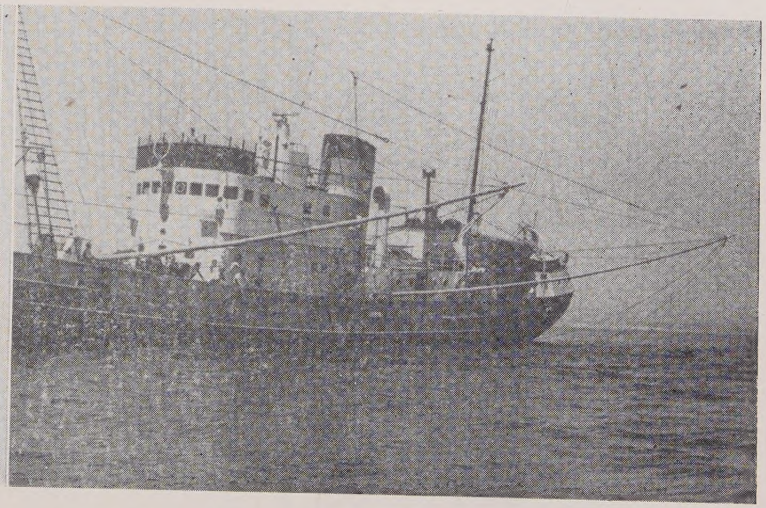
(a) Net initially set.



(b) Pulling the lead line in.



(c) Catch made.



(d) Catch brought inboard.

FIG. 1—THE BLANKET-NET RIGGED ON R.S. "AFRICANA II".

[*Photos: R. van Zyl.*

This information being available, a series of positions for the operation of the blanket-net off the West coast was chosen. These positions or blanket-net stations were placed at regular intervals of approximately 15 miles along the coast between Table Bay and Lambert's Bay with an extra station made in Saldanha Bay. The stations numbered eleven in all and covered the entire extent of the commercial pilchard and maasbanker fishing area of the West coast (see Fig. 2). They also covered the area of main occurrence of juvenile pilchards and maasbankers according to information obtained previously with the aid of explosives, bird-shooting, etc. The stations were placed as close to the shore as possible within the navigational limits of *Africana II* and averaged two miles from the land.

A standard procedure at each station was rigidly adhered to; this procedure was as follows:—

The stations were worked in total darkness and during the period of dark moon each month. The first station for the night was started two hours after official sunset and the last station was completed one hour before official sunrise.

During all fishing operations with the net, ship's lighting was reduced to the minimum necessary for compliance with the international safety of life at sea regulations, thus ensuring that no light other than the attraction light was shown near the net.

The total *fishing time* at each station was 30 minutes, but any number of hauls could be made at a single station at the discretion of the biologist in charge as long as the time taken for hauling in the net, brailing, etc., was deducted from the fishing time. For example, on one station few or no fish may have been observed during the 30 minutes of occupation. In this case the net would be hauled in as soon as 30 munites had passed and the catch, if any, collected. If, on the other hand, large numbers of small fish were noticed within a few minutes of the attraction light having been switched on, a haul was made right away, the catch collected and the net reset. This was repeated as long as fish were present until 30 minutes fishing time had elapsed. In this manner, the maximum number of juvenile fish were caught at each station in the half-hour of fishing time available.

At each station a surface water sample was taken for salinity analysis and a surface temperature taken. An N70 vertical plankton tow-net haul was made from 100–0 metres or from 5 metres from the bottom to the surface in the case of depths less than 105 metres. Meteorological observations were also made.

The total catch for each station was collected from the deck and taken to the laborotary where the juvenile stages of the various species of fish were identified and sorted. Invertebrates such as young rock lobster (*Jasus lalandii*) were treated in a similar manner.

A sample consisting of 50 fish was worked, whenever numbers permitted, for each species of fish of commercial or potential commercial importance. The collection and working of a sample of fish was carried out as follows:—

The total number of fish was counted and this total divided by 50, e.g. say there were 500 juvenile pilchards in the catch at one station; then $\frac{500}{50} = 10$. The total catch of pilchards was again counted but every tenth fish was saved, thus providing a sample of 50 fish which had been taken in a manner giving the best representation of the catch.

If the total catch of a particular species of commercially important fish was less than 50, the entire catch was treated as a sample and examined accordingly. If the total catch was less than 100, the first 50 fish were taken.

The treatment of each sample was similar to that used for the samples of commercial catches of pilchards and maasbankers on the West coast (Davies, 1956) i.e. particulars such as scientific name, name of catching vessel, station number, date, time of start of station, time of completion of station and number of hauls made were written at the head of a printed sample sheet.

The standard and total lengths of each fish were measured. Six fish were saved from each sample and preserved in 10 per cent formalin solution for detailed stomach content examination ashore. This was carried out in relation to the feeding studies of the pilchard and maasbanker.

In order to simplify the description of the distribution of young fish in relation to area the eleven blanket-net stations were combined as follows:—

Station Number.	Area.	Extent of Coverage.
1, 2 and 3....	Southern..	Table Bay to Dassen Island.
4, 11, 5 and 6..	Central....	Saldanha Bay to Cape Columbine.
7, 8, 9 and 10..	Northern..	Stompneus to Lambert's Bay.

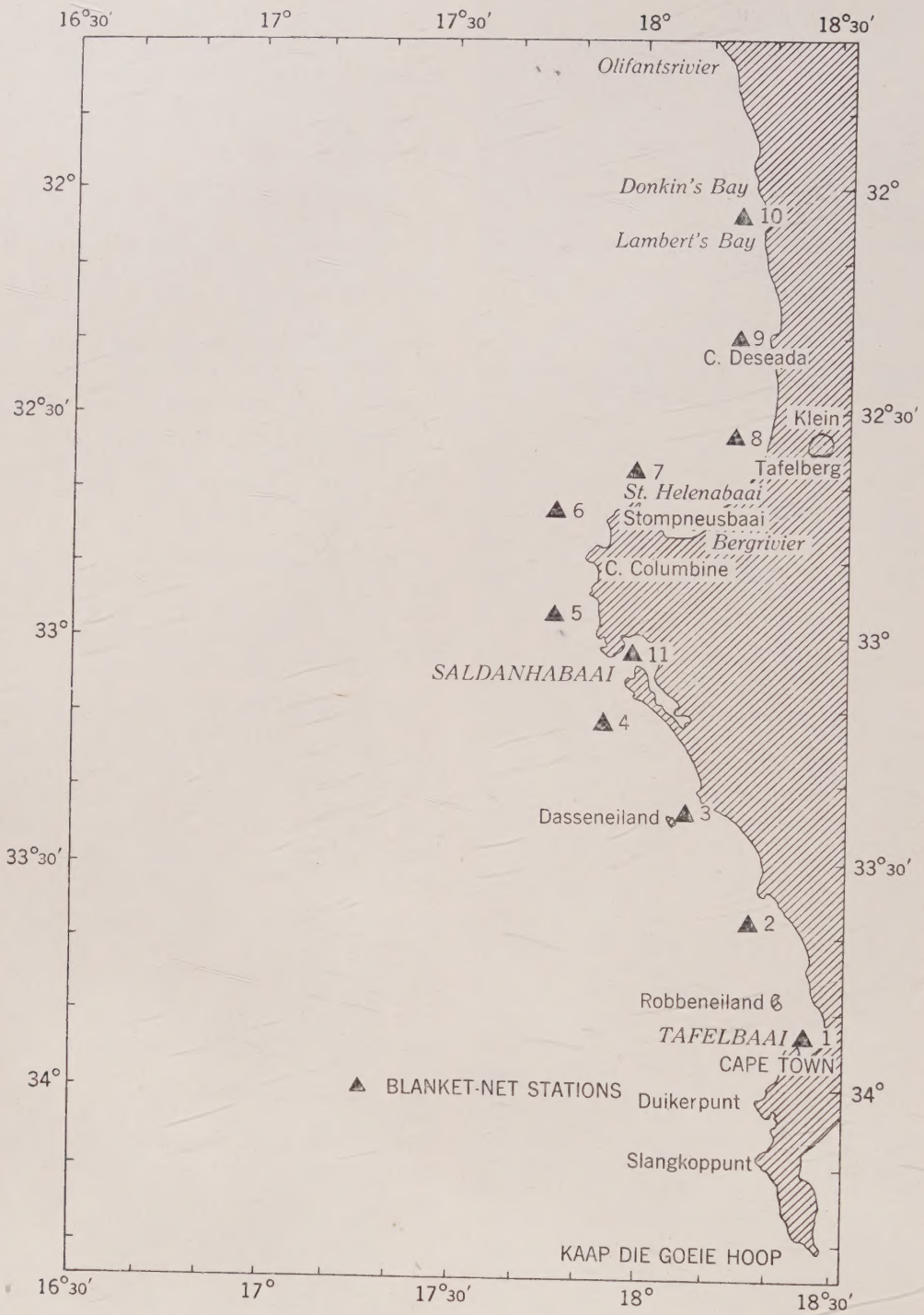


FIG 2 BLANKET-NET STATIONS FOR THE FIRST YEAR, 1955-56.

Trigsurvey, 1957

Government Printer, 1957.

4. Distribution and Abundance of Juvenile Fish.

(a) In Relation to Area and Season.

Juveniles of the following species of fish were obtained in blanket-net catches during the year:—

(1) Pilchard (*Sardinops ocellata*).
(2) Maasbanker (*Trachurus trachurus*).
(3) Anchovy (*Engraulis japonicus*).
(4) Round Herring (*Etrumeus micropus*).
(5) Mackerel (*Scomber japonicus*).
(6) Cape Rockling (*Gaidropsarus capensis*).
(7) Steenklipvis (*Palunolepis brachydactylus*).
(8) Bank Steenbras (*Palunolepis grandis*).
(9) Elf or Shad (*Pomatomus saltator*).
(10) Harder or Mullet (*Liza ramada*).
(11) Vlei Sardine (*Atherina breviceps*).
(12) Snoek (*Thyrsites atun*).
(13) Stockfish (*Merluccius capensis*).
(14) Sole (*Austroglossus microlepis*).
(15) Skipper (*Scomberesox saurus*).
(16) Gurnard (*Trigla capensis*).
(17) Trumpet fish (*Macrorhamphosus gracilis*).
(18) Sand Eel (*Ammodytes capensis*).
(19) Joseph (*Callorhynchus capensis*).
(20) Klipfish (*Clinus superciliosus*).

Invertebrates caught in the blanket-net during the year were as follows:—

(1) Cape Rock Lobster juveniles (*Jasus lalandii*).
(2) *Megalopa* Crab larvae.
(3) Squid (*Loligo reynaudi*).
(4) Isopods (mainly *Paridotea*).
(5) Polychaete worms (mainly *Platynereis dumerlii*).
(6) Stomatopod larvae (*Squilla armata*).

Detailed treatment was, however, given only to the juveniles of commercially important or potentially commercially important species, viz. pilchard, maasbanker, anchovy, round herring and mackerel.

During the year, juvenile pilchards were recorded at various times at all the blanket-net stations with the exception of station 5 (see Fig. 2). The extent of their distribution was therefore from Table Bay to Lambert's Bay.

Young maasbankers were recorded at all blanket-net stations during the year; their distribution was thus from Table Bay to Lambert's Bay.

Round herring juveniles were recorded at most stations during the year. No young round herring were obtained at stations 5, 6 and 7, i.e. between Saldanha Bay and Stompneus.

Young anchovies were obtained at all stations except numbers 2, 3 and 10.

Juvenile mackerel were found at three stations only, viz. 1, 8 and 11.

It is seen therefore that the area chosen for monthly coverage with the blanket-net was frequented in its entirety by juvenile pilchards and maasbankers, to a large extent by young round herring and anchovies and to a small degree by juvenile mackerel.

The occurrence of the young* fish obtained during the first year of the blanket-net survey is best considered by species. Charts showing the seasonal distribution of the five species mentioned above may be seen in Plates 1–4.

Pilchards (see Fig. 2, Table 1 and Plates 1–4).

During *winter* (see Plate 1) pilchard juveniles were obtained at two stations only, one in the extreme north at Lambert's Bay and the other in the central area of Saldanha Bay.

Young pilchards were present in these areas during the winter months but in small numbers only. The total number recorded for the winter season was 8.

In *spring* (see Plate 2) young pilchards were widely distributed in numbers ranging from 2 in the north (station 8) to 376 at Saldanha Bay in the central area.

Juvenile pilchards were more widely distributed in spring than in winter and were present in much larger numbers. The greatest concentration was at Saldanha Bay, and the total extent of their distribution was between Klein Tafelberg and Table Bay; the total number obtained for the season was 479.

During the *summer* months (see Plate 3) juvenile pilchards were obtained at all stations, except numbers 5 and 10, in numbers ranging from 1 to 2,164. The largest catch was obtained off Klein Tafelberg.

Young pilchards were most widely distributed and present in greatest numbers during summer. The largest concentrations occurred off Klein Tafelberg and Cape Deseada in the north, and small numbers were recorded in the south. The total number of young pilchards obtained during the summer was 2,692.

* For purposes of this paper "young" is regarded as being synonymous with "juvenile".

In *autumn* (see Plate 4) juvenile pilchards were obtained mainly in the north. Numbers per station varied from 1 to 480 and the total number recorded for the season was 493.

During this season the majority of young pilchards were concentrated to the north in the St. Helena Bay area, but were present in far smaller numbers than in summer.

Summary. (*See Table* 1 *and Plate* 5).

The season in which the smallest number of pilchard juveniles occurred was winter. Numbers increased rapidly in spring and reached a maximum in summer. A sharp decline took place in autumn and continued through to the winter minimum.

Young pilchards were found mainly in the central area of Saldanha Bay in winter, and were widespread throughout the area between Cape Deseada and Table Bay in spring and summer although the largest numbers were found in summer in the northern area. In autumn they were found mainly in the south.

Maasbanker (*see Fig.* 2, *Table* 2 *and Plates* 1–4).

During *winter* (see Plate 1) young maasbankers were recorded at stations in the central and northern areas from Saldanha Bay to Lambert's Bay in fair numbers.

The total catch for the season was 2,093 fish.

In *spring* (see Plate 2) juvenile maasbankers were recorded at Table Bay in the south, Saldanha Bay in the central area and in the region of Cape Columbine and St. Helena Bay. The greatest concentration was in the vicinity of St. Helena Bay in the north and during this season the largest total catch of young maasbankers was obtained, viz., 13,601.

In *summer* (see Plate 3) maasbanker juveniles were widespread and were recorded at most stations between Table Bay in the south and Cape Deseada in the north.

In spite of this wide distribution, however, they were nowhere plentiful and appeared to be scattered in small numbers throughout the area. The smallest catch for any one season was obtained in summer and totalled 301.

During *autumn* (see Plate 4) young maasbankers were still widely distributed and occurred at most stations between Table Bay and Cape Deseada.

An increase in numbers took place during autumn and a total catch of 7,129 was recorded for the season.

Summary (*see Table* 2 *and Plate* 5).

The season in which the smallest number of maasbanker juveniles occurred was summer. Numbers increased considerably in autumn, but declined again in winter. A rapid increase then occurred to produce the maximum in spring.

Young maasbankers were found to be widely distributed throughout the southern, central and northern areas during the summer. In autumn they were still as widely distributed, although they were more concentrated in the central area. In winter their distribution was confined to the central and northern areas but in spring they were recorded in all three areas but were more concentrated within each area, i.e. although the largest numbers of young maasbankers were obtained in this season, they were obtained from four stations only. Apart from station 6, *these were the most sheltered of all the stations, viz., Table Bay, Saldanha Bay and St. Helena Bay.*

It is interesting to note that the seasonal abundance of juvenile pilchards and maasbankers was by no means the same. The abundance of both species was relatively low in winter, but in spring the numbers of maasbankers increased to a maximum while a slight increase in the numbers of pilchards took place. In summer, maasbanker abundance was at a minimum while the numbers of pilchards reached a maximum. In autumn the numbers of maasbankers increased while the numbers of pilchards decreased.

The distribution of the two species was also subject to variation. In winter, maasbanker juveniles were fairly evenly distributed between Saldanha Bay and Lambert's Bay, while pilchards were recorded at the northern (Lambert's Bay) and southern (Saldanha Bay) extremities of this area only. In the spring and summer the distribution of juvenile pilchards and maasbankers was similar for both species and generally covered the southern, central and northern areas. In autumn, young maasbankers were widely distributed throughout the three areas while pilchard juveniles were recorded in the south, were entirely absent in the central area and were widespread in the northern area.

Anchovy (*see Fig.* 2, *Table* 3 *and Plates* 1–4).

During *winter* (see Plate 1) juvenile anchovies were recorded in blanket-net catches in small numbers in the central area only. Most were obtained in Saldanha Bay. Only 34 fish were caught in the season.

In *spring* (see Plate 2) young anchovies were present in relatively large numbers in Table Bay and a small number was obtained in Saldanha Bay.

In this season young anchovies were most abundant but the total catch consisted of only 196 fish.

In *summer* (see Plate 3) young anchovies were widely dispersed and were recorded between Table Bay and St. Helena Bay. They were nowhere very numerous, however, and the total catch for the season was 63.

During *autumn* (see Plate 4) young anchovies were evenly distributed in the central and northern areas but were entirely absent in the south. The total catch for the season was 50 fish.

Summary.

The smallest numbers of anchovies occurred in the winter. Numbers increased rapidly to a maximum in spring and then declined in summer and autumn.

In winter, anchovy juveniles were confined to the central area; in spring they were present in the central and southern areas while in summer they were recorded in all three areas. In autumn they were absent from the southern area but were widely distributed in the central and northern areas.

Round Herring (see Fig. 2, Table 4 and Plates 1–4).

In *winter* (see Plate 1) young round herring were recorded only at Saldanha Bay in relatively small numbers, the total for the season being 193.

During *spring* (see Plate 2) round herring juveniles were present in all three areas but the main concentration was in Table Bay. Altogether 1,095 young round herring were caught during the spring months.

In *summer* round herring juveniles were widely distributed throughout the three areas and present in maximum concentrations. Altogether 2,221 juveniles were recorded during the summer.

In *autumn* young round herring were present in the three areas but numbers recorded had decreased considerably compared with those of the previous season. The total catch for autumn was 387 fish.

Summary.

The lowest catches of juvenile round herring occurred during the winter. They increased in abundance in spring and reached a maximum in summer. Numbers then declined during autumn through to a minimum in winter.

Young round herring were generally distributed in the three areas in all seasons except winter. During winter they were entirely absent except in Saldanha Bay.

(*b*) In Relation to Temperature.

A surface temperature was taken at every blanket-net station during the year. These temperatures are shown in Table 5. Seasonal mean surface temperatures were calculated (see Table 6).

For stations 1 to 9 inclusive, i.e., from Table Bay to Cape Deseada but excluding Saldanha Bay (see Fig. 2) temperatures showed similar general trends of fluctuation. Due to the diurnal effects of solar radiation the values of surface temperatures are considered to be of importance in relation to general trends only.

While a considerable range of temperature was recorded for stations 1–9, viz. 11·00–16·80°C, the general tendency was for the mean seasonal difference to be relatively small, viz. from 12·50°C in summer to 13·96°C in spring.

For stations 1–9 the mean temperature increased from 13·12°C in winter to 13·96°C in spring. In summer the minimum temperature of 12·50°C recorded was probably due to the effect of upwelling caused by strong southerly winds. In autumn the mean temperature rose to 13·88°C.

Juvenile pilchard catches were very low in winter, rose in spring and reached a maximum in summer and then decreased in autumn at stations 1–9. This showed an inverse relationship during summer, i.e. temperatures were lowest when juvenile pilchards were most abundant.

The numbers of maasbanker juveniles recorded at stations 1–9 varied from a few in winter to maximum in spring and very few in summer and autumn. The maximum abundance of maasbanker juveniles recorded in spring coincided with the highest mean seasonal temperatures. There was otherwise no apparent correlation.

Station 10, off Lambert's Bay, was different from the other coastal stations in that the temperature rose steadily from a winter minimum to a summer maximum and then decreased in autumn. There was no great seasonal difference in temperatures, however, and only one pilchard juvenile was recorded during the year. Maasbanker juveniles were recorded in fair numbers in winter but were not present at this station during any other season.

Station 11, in Saldanha Bay showed a different trend of variation of mean seasonal temperature. It was lowest in winter and increased rapidly through spring to a very high maximum in summer after which it decreased again in autumn. The temperature range for this station for the year was from 12·50°C to 18·20°C.

1831433—2

The abundance of pilchard juveniles at Saldanha Bay rose from a few in winter to a maximum in spring, and then declined rapidly in summer and autumn. Maximum young pilchard abundance therefore preceded maximum temperature.

The abundance of young maasbankers reached a maximum in autumn and then declined steadily through winter and spring to a minimum in summer. The maximum occurrence of juvenile maasbankers in autumn therefore occurred after the summer temperature maximum.

Along the coast between Cape Deseada and Table Bay, but excluding Saldanha Bay, maximum abundance of juvenile pilchards coincided with minimum temperatures during the summer months, whereas the maximum abundance of young maasbankers occurred with the higher temperatures recorded in spring.

In Saldanha Bay, however, the relationship between the abundance of juvenile fish and temperature was different. The maximum abundance of juvenile pilchards occurred in summer as for the coastal stations, but coincided with the high maximum seasonal temperature. The largest number of young maasbankers was recorded in autumn when temperatures had fallen from the summer maximum.

It is evident, therefore, that there is some correlation between the abundance of young pilchards and maasbankers off the west coast of South Africa and water temperature. This correlation is, however, subject to variation in relation to area (see relationship for Saldanha Bay) and is different for the two species considered.

(*c*) In Relation to Wind.

During the occupation of blanket-net stations, observations of wind direction and velocity were made (see Table 7). A comparison of these wind data with the catches of juvenile pilchards and maasbankers (see Tables 1 and 2) was made.

From this comparison it was found that juvenile pilchards were caught most frequently during the spring and summer in conditions of southerly wind. Maasbanker juveniles were caught during all seasons of the year but were caught in smallest numbers in summer.

As the wind data collected at the blanket-net stations consisted of a single observation made at each station on a single occasion each month, it was felt that the wind data collected by the Weather Bureau, Pretoria, from observations made at Cape Columbine lighthouse over the ten year period 1939–1948 would provide a more accurate picture of the seasonal variation of wind in the area. These data have already been published in tabular and diagrammatic form (Davies, 1956 *b*).

The seasonal abundance of juvenile pilchards and maasbankers, expressed as a percentage of the total catches in the blanket-net for the year, was plotted on a graph together with the southerly winds. The latter were plotted as percentage frequencies based on the data collected by the Weather Bureau and the data collected at blanket-net stations (see Plate 6).

It is evident that the seasonal abundance of juvenile pilchards follows the same trend as the graph of southerly wind based on the ten year period, although southerly wind reached a maximum in spring according to blanket-net station data. It is felt, however, that the former variation is far more likely. Pilchard juveniles are therefore most abundant during the summer when southerly winds are most prevalent.

Juvenile maasbankers, on the other hand, were present in small numbers in winter, increased in numbers in spring when southerly winds increased, but were least abundant in summer at the time of maximum occurrence of southerly wind and then increased in numbers in autumn. *It appears, therefore, that there is no relationship between the abundance of juvenile maasbankers and southerly winds.*

It is apparent, however, that *there is a direct relationship between the abundance of juvenile pilchards as shown by blanket-net catches and southerly wind. In spring and summer when southerly winds are most prevalent, juvenile pilchards are most abundant. In autumn and winter when southerly winds are least prevalent, juvenile pilchards are least abundant.*

(*d*) In Relation to Plankton.

At each blanket-net station an N70 vertical plankton tow-net was operated from a depth of 100 metres or 5 metres from the bottom to the surface and the settled volumes of these catches taken. Comparisons were made between N70 net catches and the stomach contents of juvenile pilchards and there was considerable correlation between the organisms found in the plankton and the relative quantities recorded in stomachs. The feeding of juvenile pilchards will be considered together with the feeding of adult fish in a later paper.

Settled volumes of N70 vertical nets were recorded (see Table 8) and plotted on a seasonal basis (see Plate 6).

It is evident that *the general trend of seasonal variation in the settled volumes of plankton obtained in the N70 vertical nets is very similar to the variation in the abundance of juvenile pilchards shown by the blanket-net catches.*

The food of young maasbankers was found to be more selective and did not reflect the composition of the N70V net catches to as great a degree as that of the young pilchards. (The feeding of juvenile maasbankers will be considered together with the feeding of the adult fish in a later paper). It is, perhaps, not surprising therefore *that the abundance of juvenile maasbankers shows little correlation with the seasonal variation of plankton volumes.*

There is a marked similarity between the graphs of the seasonal variation of the abundance of juvenile pilchards, the occurrence of southerly wind and the abundance of edible plankton. It is likely that *the southerly wind in causing upwelling produces conditions favourable for the growth of the plankton eaten by young pilchards.*

5. Composition of the Catches of Juvenile Fish.

From length measurements taken of young pilchards and maasbankers at the blanket-net stations (see Tables 9 and 10), length frequency graphs of the majority of catches were drawn (see Plates 7 and 8).

For convenience these graphs were placed together and each mode was labelled with the month during which the fish were caught together with the station number at which the catch was made. It was possible to arrange the graphs in this manner due to the fact that the total catches for these two species were not very large for the first year.

(*a*) Pilchards.

The catches of juvenile pilchards (see Plate 7) fell mainly within the limits 3 to 8 cm standard length, but a varied assortment of dominant length groups was recorded during the year.

It is of considerable interest to compare the possible increase in size of the young pilchards recorded at the various stations during successive months. For example, at station 11 during the period of three months from September to December the increase in length of the catches of juvenile pilchards was shown to be 1·5 cm. On the other hand, at the same station an increase of only 1 cm in length was recorded over the five month period September to February.

From this it is evident that an idea of growth could be obtained from these data only if they were examined in conjunction with age determination data obtained from the same fish. Scale samples were taken of all catches of juvenile pilchards and maasbankers, but have not as yet been fully examined.

Furthermore, if age determination data were available, it would not be a simple matter to determine the growth of young pilchards and maasbankers due to the fact that scale rings only appear later. A further complication lies in the fact that extensive migration takes place among the young of these two species, and it would therefore be difficult or impossible to say whether samples taken at a particular station would be representative of shoals which had remained there for long periods or whether they represented successive migratory shoals which had taken their place.

For the moment, however, let us assume that the young pilchards remained at the same stations during the period under discussion. If this were the case then an examination of the successive modes of the graph shows that the increase in standard lengths was as follows:—

1·5 cm in 3 months (mentioned earlier in this section).

1·0 cm in 5 months (mentioned earlier in this section).

2·4 cm in 3 months (station 7, November to February).

2·5 cm in 3 months (station 8, December to March).

This shows a minimum growth of 1 cm over a period of 5 months, an average growth of 1·9 cm in 3·5 months and a maximum growth of 2·5 cm in 3 months.

Under good conditions with an abundant food supply the growth rate of approximately 2·5 cm in 3 months is considered to be quite feasible.

At this stage therefore it may be stated *that juvenile pilchards of standard lengths* 3 *to* 8 *cm may grow at the rate shown by an increase in length of* 0·8 *cm per month.* Further investigations including age determination studies which are being carried out should provide additional information on their growth rate.

(*b*) Maasbankers.

The catches of juvenile maasbankers consisted of fish of fairly wide standard length range from 3 to 15 cm. The modes of the dominant length groups are shown in the graph (see Plate 8).

In the same manner as that used for juvenile pilchards (see above) the increase in the standard lengths of juvenile maasbankers was as follows:—

5 cm in 4 months (station 1, December to April).

2 cm in 4 months (station 1, December to April).

2·5 cm in 3 months (station 8, December to March).

2·5 cm in 3 months (station 11, December to March).

This shows a minimum growth of 2 cm over a period of 4 months, an average growth of 3 cm in 3·5 months and a maximum growth of 5 cm in 4 months.

Under good conditions with an abundant food supply, the growth rate of 5 cm in 4 months is considered to be quite feasible for the maasbanker which is a larger fish than the pilchard.

It may be stated that *juvenile maasbankers of standard lengths* 3 *to* 15 *cm may grow at the rate of approximately* 1·25 *cm in length per month.* Further investigations, including age determination studies which are at present being carried out, may provide additional information on their growth rate.

(c) Others.

Length data recorded of catches of juvenile anchovies and round herring were not treated in the same detail as that of the commercially important young pilchards and maasbankers. Some indication of the size of anchovies (see Table 11) and round herring (see Table 12) caught in the blanket-net catches is given.

6. General Discussion.

While a knowledge of the occurrence and distribution of juvenile pilchards and maasbankers together with the relationship between these factors and such factors as season, temperature, wind and plankton is of considerable importance, the ultimate object of the blanket-net survey is to be able to relate the quantitative results of the survey with the commercial catches of larger fish.

In other words, a well conducted quantitative survey of juveniles in their first six months of life should yield information which will permit a reliable forecast of the composition and size of the commercially fishable stock, say two years later, when those juveniles enter the fishery.

For this to be possible, it is necessary to have completed a satisfactory study of the age determination of the fish and then to be able to link the data obtained from the juvenile fish survey with the catch data from the appropriate year in the fishery in such a manner that the results obtained will be statistically significant.

Age determination studies for the pilchard are nearing completion but for the maasbanker are far from finished. Within the next two years, however, there is every hope that it will be possible to link the blanket-net survey of juvenile pilchards and maasbankers with the commercial catches in such a manner that forecasts of good and bad fishing years will be possible.

7. Acknowledgments.

I am indebted to Dr. J. M. Marchand, Director of Fisheries and my colleagues of the Division of Fisheries for reading and criticising this paper, to Mr. R. P. van Zyl for taking the photographs, Dr. Marchand for advice and assistance with the photography and Mr. M. Thomson for assistance in processing the data.

8. References.

Davies, D. H., 1956 (*a*).—*The South African Pilchard* (*Sardinops ocellata*). *Sexual Maturity and Reproduction*, 1950–54. Dept. of Com. and Ind., Div. of Fish., Invest. Report No. 22, pp. 1–155. Pretoria.

Davies, D. H., 1956 (*b*).—*The South African Pilchard* (*Sardinops ocellata*) *and Maasbanker*(*Trachurus trachurus*). *Bird Predators*, 1954–55. Dept. of Com. and Ind., Div. of Fish., Invest. Report No. 23, pp. 1–40. Pretoria.

Marchand, J. M., Shannon, V. and Clark, A., 1951.—*The Fisheries Research Ship "Africana II"*. Dept. of Com. and Ind., Div. of Fish., Fish. Bull. No. 3, pp. 1–47. Pretoria.

Phillips, J. B. and Radovich, J., 1952.—*Surveys through* 1951 *of the Distribution and Abundance of Young Sardines* (*Sardinops caerulea*). Department of Fish and Game, Bureau of Marine Fisheries, Fish. Bull. No. 87, pp. 1–63. San Francisco.

Radovich, J. and Gibbs, E., 1954.—*The Use of a Blanket Net in Sampling Fish Populations.* California Fish and Game, 40, No. 4, pp. 353–365. San Francisco.

Smith, J. L. B., 1954.—*The Sea Fishes of Southern Africa.* Central News Agency, pp. 1–564. Cape Town.

TABLE 1.

SEASONAL VARIATION IN THE NUMBERS OF PILCHARD JUVENILES PER STATION (BLANKET-NET, 1955/56).

Area.	Station Number.	Season.			
		Autumn.	Winter.	Spring.	Summer.
Southern	1	6	—	63	5
	2	—	—	—	7
	3	—	—	3	4
Central	4	—	—	—	1
	11	—	7	376	108
	5	—	—	—	—
	6	—	—	—	1
Northern	7	1	—	35	42
	8	480	—	2	2,164
	9	6	—	—	360
	10	—	1	—	—
	Total	493	8	479	2,692
	Percentage.	13	1	13	73

TABLE 2.

SEASONAL VARIATION IN THE NUMBERS OF MAASBANKER JUVENILES PER STATION (BLANKET-NET, 1955/56).

Area.	Station Number.	Season.			
		Autumn.	Winter.	Spring.	Summer.
Southern	1	37	—	551	29
	2	1	—	—	3
	3	—	—	—	6
Central	4	1	—	—	—
	11	7,000	1,111	748	171
	5	1	—	—	—
	6	7	528	1	—
Northern	7	2	12	12,301	56
	8	75	1	—	9
	9	5	168	—	27
	10	—	273	—	—
	Total	7,129	2,093	13,601	301
	Percentage.	31	9	59	1

TABLE 3.

SEASONAL VARIATION IN THE NUMBERS OF ANCHOVY JUVENILES PER STATION (BLANKET-NET, 1955/56).

Area.	Station Number.	Season.			
		Autumn.	Winter.	Spring.	Summer.
Southern	1	—	—	187	8
	2	—	—	—	—
	3	—	—	—	—
Central	4	15	—	—	—
	11	5	32	9	50
	5	6	—	—	—
	6	3	2	—	—
Northern	7	15	—	—	3
	8	5	—	—	2
	9	1	—	—	—
	10	—	—	—	—
	Total	50	34	196	63
	Percentage.	15	10	57	18

TABLE 4.

SEASONAL VARIATION IN THE NUMBERS OF ROUND HERRING JUVENILES PER STATION (BLANKET NET, 1955/56).

Area.	Station Number.	Season.			
		Autumn.	Winter.	Spring.	Summer.
Southern	1	41	—	885	39
	2	—	—	—	1
	3	—	—	—	11
Central	4	—	—	—	2
	11	91	193	208	2,127
	5	—	—	—	—
	6	—	—	—	—
Northern	7	116	—	1	—
	8	33	—	1	30
	9	106	—	—	10
	10	—	—	—	1
	Total	387	193	1,095	2,221
	Percentage.	10	5	28	57

Table 5.

Surface temperatures at Blanket-net Stations, 1955/56.

Month.	Surface Temperatures at Blanket-net Stations in ° C.											1–11 Mean.
	St. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
1955—												
August.....	13·45	13·05	12·85	14·00	14·30	12·30	12·45	12·50	12·10	12·60	12·50	12·9
September..	13·10	14·67	14·30	13·72	14·60	14·33	13·10	13·29	13·13	12·56	14·67	13·8
October....	11·55	14·70	13·50	13·60	14·10	12·60	12·15	12·55	12·10	12·25	14·40	13·0
November..	16·10	15·60	16·80	16·50	15·90	14·20	12·85	13·90	14·00	13·60	17·15	15·1
December..	13·50	14·00	15·00	14·00	13·00	12·00	12·50	13·50	13·00	13·50	15·50	13·6
1956—												
January....	11·20	11·50	12·20	13·00	11·90	10·50	11·00	12·00	13·00	13·80	18·20	12·6
February...	12·20	12·70	13·30	11·80	11·50	12·61	12·10	12·20	12·40	13·20	17·80	12·9
March.....	14·00	14·00	14·50	15·00	14·50	11·50	13·50	13·50	14·00	13·50	17·00	14·1
April.....	14·30	14·30	13·90	14·90	13·90	15·15	12·90	13·10	13·70	13·05	14·40	14·0
May.....	14·50	15·00	15·00	15·00	15·00	13·00	12·00	12·00	12·50	12·00	14·00	13·6
June.....	—	—	—	14·50	14·10	12·35	11·95	11·90	—	—	12·85	12·9
July.....	13·60	—	13·50	13·50	12·60	15·80	12·90	13·10	12·40	12·60	13·00	13·3

Table 6.

Mean Surface Temperatures per Season for Blanket-net Stations.

Season.	Surface Temperatures at Blanket-net Stations in ° C.										
	Sta. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1955–56—											
Winter.....	13·52	13·05	13·18	14·00	13·67	13·48	12·43	12·50	12·25	12·60	12·78
Spring.....	13·58	14·99	14·87	14·61	14·87	13·71	12·70	13·25	13·08	12·80	15·41
Summer.....	12·30	12·73	13·50	12·93	12·13	11·70	11·87	12·57	12·80	13·50	17·17
Autumn.....	14·27	14·43	14·47	14·97	14·47	13·22	12·80	12·87	13·40	12·85	15·13

Table 7.

Winds Recorded at Blanket-net Stations during the Period July, 1955–July, 1956.

Station No.	Wind direction and strength.											
	Aug. (1955).	Sept.	Oct.	Nov.	Dec.	Jan. (1956).	Feb.	March.	April.	May.	June.	July.
1	Calm 0	160 ° 24	210 ° 5	Calm 0	115 ° 5	170 ° 18	270 ° 2	Calm 0	Calm 0	350 ° 9	—	160 ° 24
2	240 ° 2	160 ° 18	210 ° 5	210 ° 5	350 ° 5	150 ° 13	325 ° 5	220 ° 2	Calm 0	330 ° 5	—	—
3	290 ° 9	140 ° 18	180 ° 2	190 ° 5	Calm 0	160 ° 9	010 ° 2	190 ° 2	Calm 0	300 ° 2	—	160 ° 24
4	250 ° 5	—	170 ° 5	150 ° 5	030 ° 5	180 ° 13	130 ° 2	350 ° 5	Calm 0	Calm 0	020 ° 5	170 ° 2
5	280 ° 2	160 ° 5	180 ° 9	170 ° 13	190 ° 18	180 ° 13	170 ° 5	010 ° 9	170 ° 2	Calm 0	020 ° 5	180 ° 5
6	Calm 0	160 ° 9	170 ° 5	150 ° 13	180 ° 18	180 ° 5	135 ° 9	340 ° 5	190 ° 5	250 ° 2	—	220 ° 5
7	240 ° 5	140 ° 5	210 ° 13	150 ° 13	360 ° 5	190 ° 2	150 ° 2	165 ° 13	010 ° 2	Calm 0	010 ° 5	Calm 0
8	240 ° 5	170 ° 2	245 ° 5	160 ° 2	360 ° 2	240 ° 2	180 ° 5	170 ° 5	050 ° 2	120 ° 5	270 ° 9	Calm 0
9	290 ° 5	170 ° 2	130 ° 2	170 ° 5	010 ° 2	Calm 0	225 ° 9	170 ° 2	Calm 0	170 ° 5	—	Calm 0
10	310 ° 13	160 ° 2	190 ° 1	170 ° 9	360 ° 5	Calm 0	210 ° 5	180 ° 5	240 ° 2	180 ° 5	—	Calm 0
11	Calm 0	Calm 0	170 ° 5	170 ° 13	190 ° 18	180 ° 13	Calm 0	010 ° 2	160 ° 2	Calm 0	Calm 0	Calm 0

Table 8.

Settled Volumes of Plankton at Blanket-net Stasions, 1955/56.

Month.	Settled Volumes of N 70 V net Catches at Blanket-net Stations in CC.											1–11 Mean.
	St. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10	11.	
1955—												
August	7	5	17	8	10	10	15	16	10	20	5	11
September	5	11	17	11	18	9	25	17	30	19	No haul taken.	16
October	7	8	22	10	10	16	25	30	43	18	21	19
November	5	20	12	17	65	60	33	41	20	26	7	28
December	31	12	7	13	23	30	36	62	74	10	3	27
1956—												
January	66	60	17	21	14	60	25	12	48	10	1	30
February	5	20	15	30	70	110	102	76	29	40	1	45
March	24	21	24	16	31	50	44	11	5	8	10	22
April	1	22	14	13	15	5	3	29	10	8	10	12
May	9	22	18	20	36	42	42	50	24	10	70	31
June	—	—	—	6	52	17	25	7	—	—	50	26
July	1	—	3	8	3	6	1	9	55	30	85	20

Table 9.

Length Frequencies of Pilchards Caught in Blanket-net, 1955/56.

Station Number.	Length Group cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
1.....	3·5– 3·9.....	—	—	—	—	—	—	—	—	—	—	1	100	1	25	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	1	2	—	—	—	—	1	25	1	50	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	7	14	—	—	—	—	—	—	1	50	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	16	32	—	—	—	—	1	25	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	15	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	9	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	1	25	—	—	—	—	—	—	—	—	—	—
	8·0– 8·4.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	33	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	33	—	—	—	—	—	—
	9·5– 9·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	33	—	—	—	—	—	—
	10·0–10·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	50	—	—	—	1	—	4	—	2	—	3	—	1	—	—	—	—	—
2.....	3·5– 3·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	1	100	1	20	—	—	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9.....	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—
	10·0–10·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·0–11·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	1	—	5	—	1	—	—	—	—	—	—	—	—	—	—	—

Reprint from "Commerce & Industry", October, 1957

TABLE 9.

LENGHT FREQUENCIES OF PILCHARDS CAUGHT IN BLANKET-NET, 1955/56. (*Continued.*)

Station Number.	Length Group cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
3.....	3·5– 3·9.....	—	—	—	—	—	—	—	—	1	33	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	1	33	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	1	33	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·0–10·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	1	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·0–11·4.....	—	—	1	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	TOTAL.....	—	—	2	—	—	—	1	—	3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
4.....	6·0– 6·4.....	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	TOTAL.....	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5.....	No Pilchards were caught																								
6.....	No Pilchards were caught																								

Table 9.

Lenght Frequencies of Pilchards Caught in Blanket-net, 1955/56 (*Continued*).

Station Number.	Length Group cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
7.....	3·0– 3·4.....	—	—	—	—	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	13	38	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	14	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	6	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	—	—	—	—	5	12	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	—	—	—	—	11	26	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	—	—	—	—	13	31	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	12	29	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·0–10·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·0–11·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·0–12·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·5–12·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	34	—	—	—	—	—	42	—	1	—	—	—	—	—	—	—	—	—
8.....	3·0– 3·4.....	—	—	1	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	7	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	14	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	1	100	13	26	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	4	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	7	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	3	6	—	—	—	—	3	6	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	1	100	24	48	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	1	2	—	—	—	—	15	30	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	14	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—
	Total.....	—	—	1	—	—	—	1	—	50	—	—	—	1	—	50	—	—	—	—	—	—	—	—	—

Reprint from "Commerce & Industry", October, 1957

Table 9.

Lenght Frequencies of Pilchards Caught in Blanket-net, 1955/56 (*Continued*).

Station Number.	Length Group. cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		Mayl		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
9.....	3·0– 3·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9	—	—	—	—	—	—	—	—	5	10	—	—	—	—	—	—	—	—	—	—	—	—	1	100
	4·0– 4·4	—	—	—	—	—	—	—	—	13	26	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9	—	—	—	—	—	—	—	—	19	38	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4	—	—	—	—	—	—	—	—	3	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9	—	—	—	—	—	—	—	—	7	14	—	—	—	—	1	25	—	—	—	—	—	—	—	—
	6·0– 6·4	—	—	—	—	—	—	—	—	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9	—	—	—	—	—	—	—	—	1	2	—	—	—	—	2	50	—	—	—	—	—	—	—	—
	7·0– 7·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	25	1	50	—	—	—	—	—	—
	8·0– 8·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	50	—	—	—	—	—	—
	9·0– 9·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	50	—	—	—	—	—	4	—	2	—	—	—	—	—	1	—
10.....	No Pilchards caught																								
11.....	3·0– 3·4	—	—	10	20	—	—	4	8	1	20	1	100	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9	—	—	27	54	—	—	29	58	—	—	—	—	3	6	—	—	—	—	—	—	—	—	7 (not measured)	
	4·0– 4·4	—	—	12	24	—	—	17	34	—	—	—	—	16	32	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9	—	—	1	2	—	—	—	—	1	20	—	—	17	34	—	—	—	—	—	—	—	—	3	25
	5·0– 5·4	—	—	—	—	2	100	—	—	2	40	—	—	11	22	—	—	—	—	—	—	—	—	1	8
	5·5– 5·9	—	—	—	—	—	—	—	—	1	20	—	—	2	4	—	—	—	—	—	—	—	—	2	17
	6·0– 6·4	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	17
	7·0– 7·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	8
	8·0– 8·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·0–10·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	8
	10·5–10·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	8
	11·0–11·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	8
	Total.....	—	—	50	—	2	—	50	—	5	—	1	—	50	—	—	—	—	—	—	—	—	—	12	—

Table 10.

Length Frequencies of Maasbankers Caught in Blanket-net, 1955/56.

Station Number.	Length Group cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
1.....	3·0– 3·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	—	—	1	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	2	4	—	—	1	100	1	4	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	6	13	1	17	—	—	6	27	—	—	2	6	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	6	13	2	33	—	—	9	41	—	—	4	11	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	4	9	1	17	—	—	5	23	—	—	4	11	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	9	20	—	—	—	—	—	—	1	50	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	5	11	—	—	—	—	—	—	—	—	2	6	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	6	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	14	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	17	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	2	4	1	17	—	—	1	4	—	—	7	20	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	1	2	2	4	—	—	—	—	—	—	1	50	—	—	—	—	—	—	—	—
	9·5– 9·9.....	—	—	—	—	1	2	6	13	—	—	—	—	—	—	—	—	3	9	—	—	—	—	—	—
	10·0–10·4.....	—	—	—	—	—	—	4	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	—	—	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·0–11·4.....	—	—	—	—	3	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9.....	—	—	—	—	14	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·0–12·4.....	—	—	—	—	11	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·5–12·9.....	—	—	—	—	14	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13·0–13·4.....	—	—	—	—	4	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13·5–13·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	50	—	46	—	6	—	1	—	22	—	2	—	2	—	—	—	—	—	—	—
2.....	2·5– 2·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—
	3·0– 3·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	1	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—
3.....	3·0– 3·4.....	—	—	—	—	—	—	—	—	2	40	—	—	1	(not measured)			—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	1	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	5	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
4.....	2·5– 2·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—

Reprint from "Commerce & Industry", October, 1957

Table 10.

Lenght Frequencies of Maasbankers Caught in Blanket-net, 1955/56 (*Continued*).

Station Number.	Length Group. cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
5.....	3·0– 3·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
6.....	2·5– 2·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·0– 3·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	34	—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	43	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	14	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·0–10·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·0–11·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	—	—	—	—	—	—	—	—	—
7.....	3·0– 3·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	8
	5·0– 5·4.....	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	10	20
	5·5– 5·9.....	—	—	—	—	—	—	—	—	—	—	—	—	5	12	—	—	—	—	—	—	—	—	20	40
	6·0 6·4.....	—	—	—	—	—	—	—	—	—	—	—	—	7	17	—	—	—	—	—	—	—	—	11	22
	6·5– 6·9.....	—	—	—	—	—	—	—	—	—	—	—	—	4	10	—	—	—	—	—	—	—	—	5	10
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	18	43	1	50	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	6	14	1	50	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	4	8	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—
	9·0– 9·4.....	—	—	8	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9·5– 9·9.....	—	—	10	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·0–10·4.....	—	—	8	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10·5–10·9.....	—	—	8	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·0–11·4.....	—	—	7	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9.....	—	—	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·0–12·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·5–12·9.....	—	—	1	2	—	—	—	—	2	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13·0–13·4.....	—	—	—	—	—	—	—	—	2	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13·5–13·9.....	—	—	—	—	—	—	—	—	5	38	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	14·0–14·4.....	—	—	—	—	—	—	—	—	2	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	2	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Total.....	—	—	50	—	—	—	—	—	13	—	—	—	42	—	2	—	—	—	—	—	—	—	50	—

Table 10.

Length Frequencies of Maasbankers Caught in Blanket-net, 1955/56 (*Continued*).

Station Number.	Length Group. cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
8.....	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	4	50	—	—	1	100	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	1	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	1	13	—	—	—	—	1	2	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	8	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	2	25	—	—	—	—	15	30	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	22	44	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	14	—	—	—	—	—	—	—	—
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—
	Total.....	—	—	—	—	—	—	—	—	8	—	—	—	—	1	50	—	—	—	—	—	—	—	—	—
9.....	3·5– 3·9.....	—	—	—	—	—	—	—	—	2	12	1	33	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4.....	—	—	—	—	—	—	—	—	—	—	2	66	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9.....	—	—	—	—	—	—	—	—	2	12	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4.....	—	—	—	—	—	—	—	—	1	6	—	—	—	—	1	25	—	—	—	—	—	—	—	—
	5·5– 5·9.....	—	—	—	—	—	—	—	—	7	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4.....	—	—	—	—	—	—	—	—	3	17	—	—	—	—	1	25	—	—	—	—	—	—	—	—
	6·5– 6·9.....	—	—	—	—	—	—	—	—	1	6	—	—	—	—	1	25	—	—	—	—	—	—	—	—
	7·0– 7·4.....	—	—	—	—	—	—	—	—	1	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	25	—	—	—	—	—	—	1	2
	8·0– 8·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	8
	8·5– 8·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	18
	9·0– 9·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	24
	9·5– 9·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13	26
	10·0–10·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	10
	10·5–10·9.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	8
	11·0–11·4.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	4
	Total.....	—	—	—	—	—	—	—	—	17	—	3	—	—	—	4	—	—	—	—	—	—	—	50	—

Reprint from "Commerce & Industry", October, 1957

Table 10.

Length Frequencies of Maasbankers Caught in Blanket-net, 1955/56 (*Continued*).

Station Number.	Length Group cm (Lc).	Aug. 1955.		Sept.		Oct.		Nov.		Dec.		Jan. 1956.		Feb.		March.		April.		May.		June.		July.	
		N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.	N.	P.
10	3·0– 3·4	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	—	—	—	—
	3·5– 3·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·0– 4·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	4·5– 4·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·0– 5·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	5·5– 5·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·0– 6·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	6·5– 6·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	7·5– 7·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
	8·0– 8·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
	8·5– 8·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	12
	9·0– 9·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13	26
	9·5– 9·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14	28
	10·0–10·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	14
	10·5–10·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	10
	11·0–11·4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	4
	11·5–11·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
	Total	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
																								50	—
11	4·5– 4·9	—	—	—	—	—	—	1	100	1	6	—	—	1	2	—	—	—	—	—	—	4*	—	1	8
	5·0– 5·4	—	—	—	—	—	—	—	—	1	6	—	—	1	2	—	—	—	—	—	—	—	—	3	23
	5·5– 5·9	—	—	—	—	—	—	—	—	8	47	—	—	5	10	—	—	—	—	—	—	—	—	2	15
	6·0– 6·4	—	—	—	—	—	—	—	—	4	23	—	—	5	10	—	—	—	—	—	—	—	—	1	8
	6·5– 6·9	—	—	—	—	—	—	—	—	3	18	—	—	8	16	—	—	—	—	—	—	—	—	—	—
	7·0– 7·4	2	4	—	—	—	—	—	—	—	—	—	—	14	28	4	8	—	—	—	—	—	—	—	—
	7·5– 7·9	10	20	4	8	—	—	—	—	—	—	—	—	8	16	4	8	—	—	—	—	—	—	—	—
	8·0– 8·4	9	18	7	14	1	50	—	—	—	—	—	—	5	10	13	26	—	—	—	—	—	—	1	8
	8·5– 8·9	8	16	8	16	1	50	—	—	—	—	—	—	2	4	10	20	—	—	—	—	—	—	—	—
	9·0– 9·4	3	6	14	28	—	—	—	—	—	—	—	—	1	2	9	18	—	—	—	—	—	—	1	8
	9·5– 9·9	5	10	11	22	—	—	—	—	—	—	—	—	—	—	6	12	—	—	—	—	—	—	3	23
	10·0–10·4	1	2	5	10	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—
	10·5–10·9	3	6	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—
	11·0–11·4	3	6	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11·5–11·9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·0–12·4	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12·5–12·9	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13·0–13·4	2	4	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—
	13·5–13·9	1	2	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	1	8
	Total	50	—	50	—	2	—	1	—	17	—	—	—	50	—	50	—	—	—	—	—	—	—	—	—
																							4	13	—

* Length Range 4–18 cm.

Table 11.

Anchovies Caught in the Blanket-net During the First Year, 1955/56.

Station No.	1			2			3			4			5			6		
Month.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.
1955—		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.
August	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
September	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
October	3	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
November	184	7·4–10·6	9·0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
December	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1956																		
January	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
February	8	3·9–5·8	4·6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
March	—	—	—	—	—	—	—	—	—	15	3·0–4·3	3·7	6	3·0–4·5	3·8	3	3·3–4·0	3·7
April	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
May	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
June	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	± 6
July	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Station No.	7			8			9			10			11		
Month.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.
1955—		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.
August	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
September	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—
October	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
November	—	—	—	—	—	—	—	—	—	—	—	—	1	—	5·5
December	—	—	—	1	—	9·8	—	—	—	—	—	—	8	4·7–8·0	6·4
1956—															
January	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
February	3	4·8–5·8	5·3	1	—	5·1	—	—	—	—	—	—	42	3·3–6·9	5·4
March	15	3·9 5·6	4·9	5	6 2–7·6	6·9	1	—	4·2	—	—	—	—	—	—
April	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
May	—	—	—	—	—	—	—	—	—	—	—	—	5	4·1–4·8	4·5
June	—	—	—	—	—	—	—	—	—	—	—	—	32	5·0–8·0	6·5
July	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Reprint from "Commerce & Industry", October, 1957

Table 12.

Round Herrings Caught in the Blanket-net during the First Year, 1955/56.

Station No.	1			2			3			4			5			6		
Month.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.
1955—		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.
August	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
September	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
October	229	4·2–5·1	4·6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
November	656	4·3–7·7	5·5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
December	—	—	—	1	—	8·1	11	—	± 6	2	5·4–7·0	5·7	—	—	—	—	—	—
1956—																		
January	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
February	39	3·6–7·0	4·3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
March	3	5·4–7·0	6·2	—	—	—	—	—	—	1	—	5·2	—	—	—	—	—	—
April	38	5·9–8·7	6·7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
May	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
June	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
July	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	6·0

Station No.	7			8			9			10			11		
Month.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.	No.	Length Range.	Mean Length.
1955—		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.		cm.	cm.
August	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
September	—	—	—	1	—	5·4	—	—	—	—	—	—	—	—	—
October	1	—	7·0	—	—	—	—	—	—	—	—	—	—	—	—
November	—	—	—	—	—	—	—	—	—	—	—	—	111	3·8–5·0	4·4
December	—	—	—	15	3·6–5·6	4·7	9	4·6–6·2	5·2	1	—	4·6	97	2·8–5·0	3·9
1956—													508	3·5–7·2	4·8
January	—	—	—	8	4·5–5·6	5·0	—	—	—	—	—	—			
February	—	—	—	7	4·7–5·7	5·0	1	—	5·9	—	—	—	3	3·7–4·2	3·9
March	116	5·0–7·9	5·8	33	5·5–7·2	6·0	104	5·5–7·3	6·5	—	—	—	1,616	3·7–7·2	4·6
April	—	—	—	—	—	—	—	—	—	—	—	—	7	3·7–4·9	4·3
May	—	—	—	—	—	—	2	4·2–5·1	4·7	—	—	—	1	—	3·8
June	—	—	—	—	—	—	—	—	—	—	—	—	83	4·0–5·1	4·4
July	—	—	—	—	—	—	—	—	—	—	—	—	37	5·0–6·0	5·5
													156	4·1–5·5	4·7

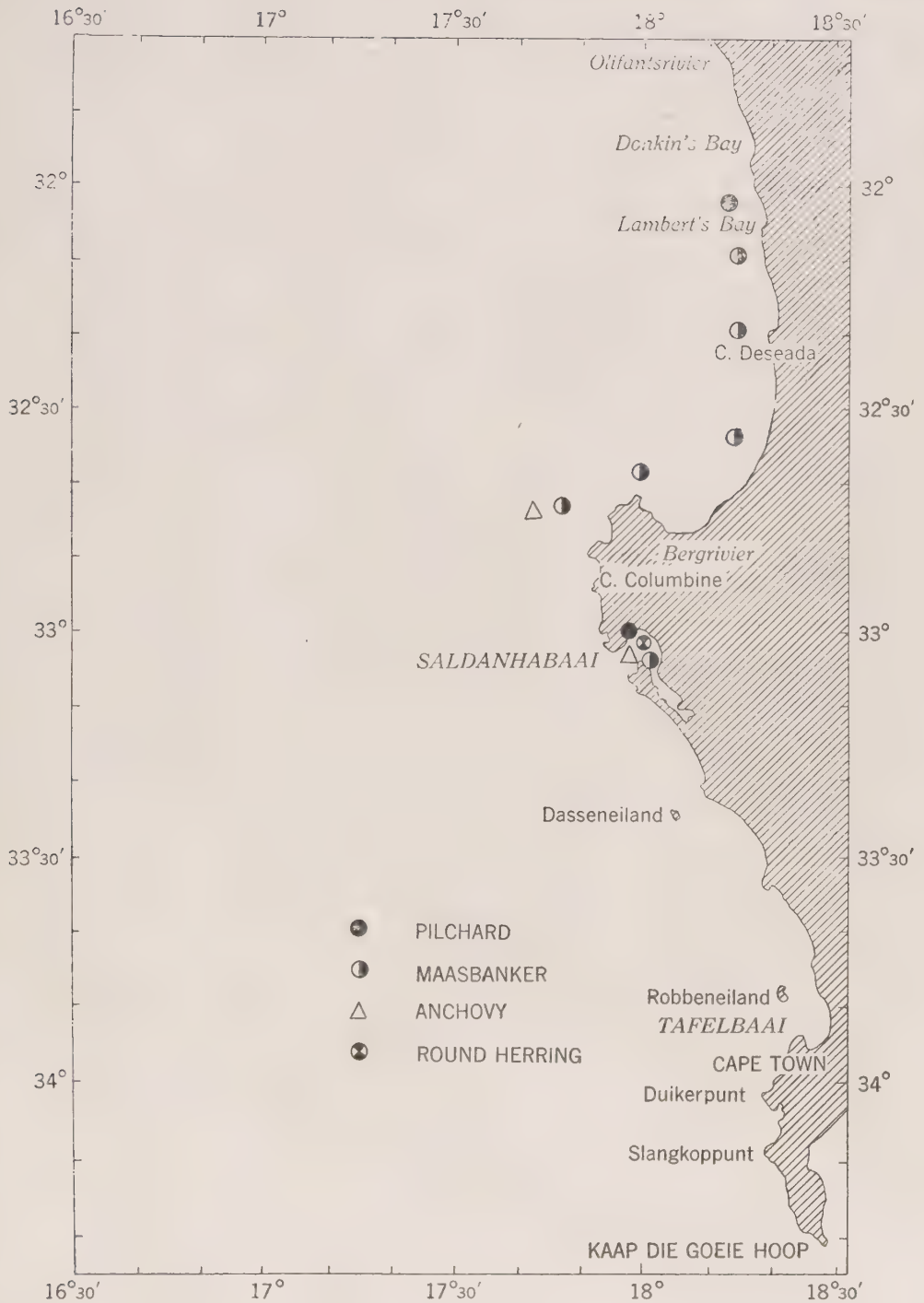


PLATE 1 DISTRIBUTION OF JUVENILE FISH IN WINTER, 1955-56.

Trigsurvey, 1957. Government Printer, 1957.

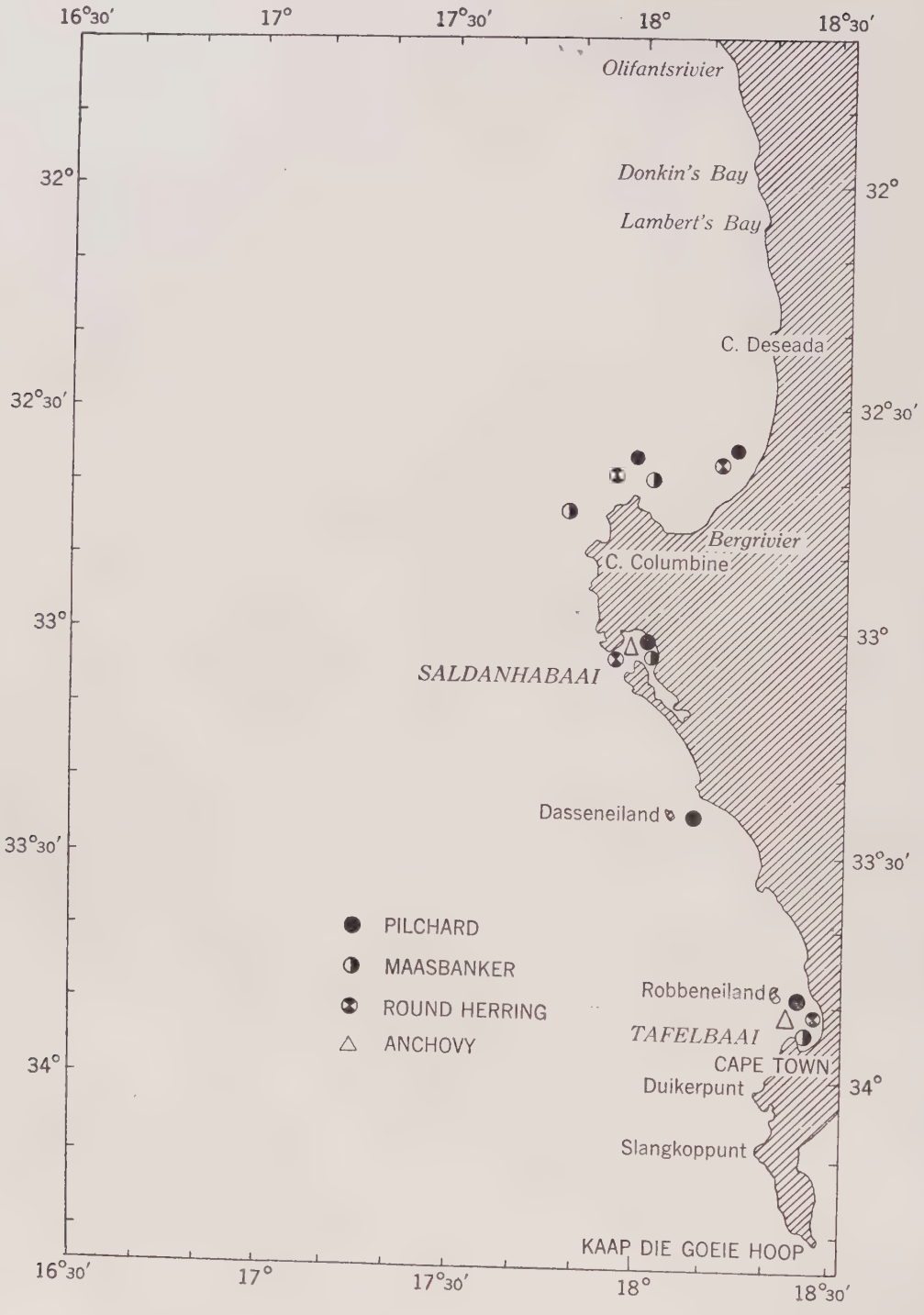


PLATE 2 DISTRIBUTION OF JUVENILE FISH IN SPRING, 1955.

Trigsurvey, 1957.

Government Printer, 1957.

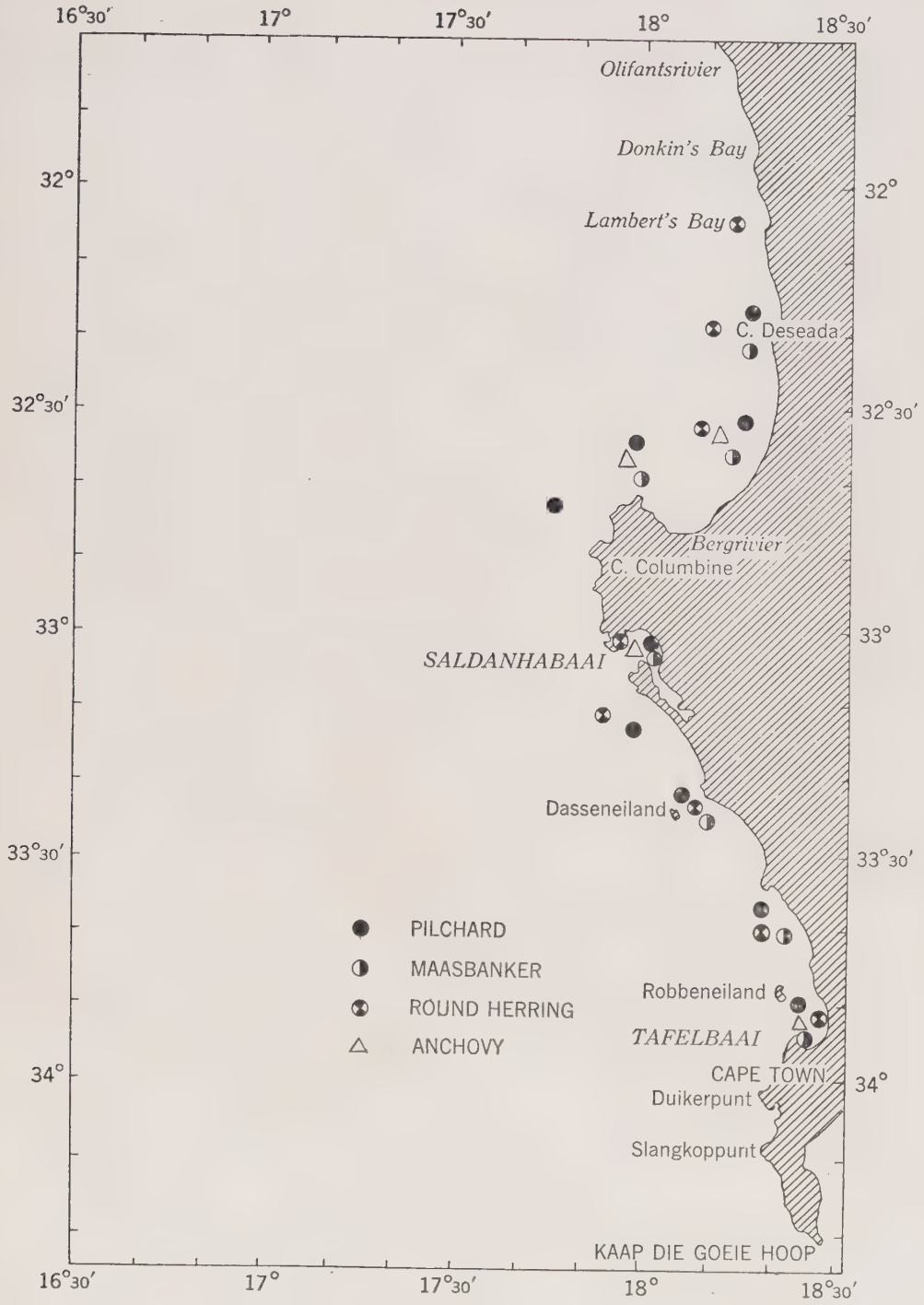


PLATE 3 DISTRIBUTION OF JUVENILE FISH IN SUMMER, 1955-56

Trigsurvey, 1957.

Government Printer, 1957.

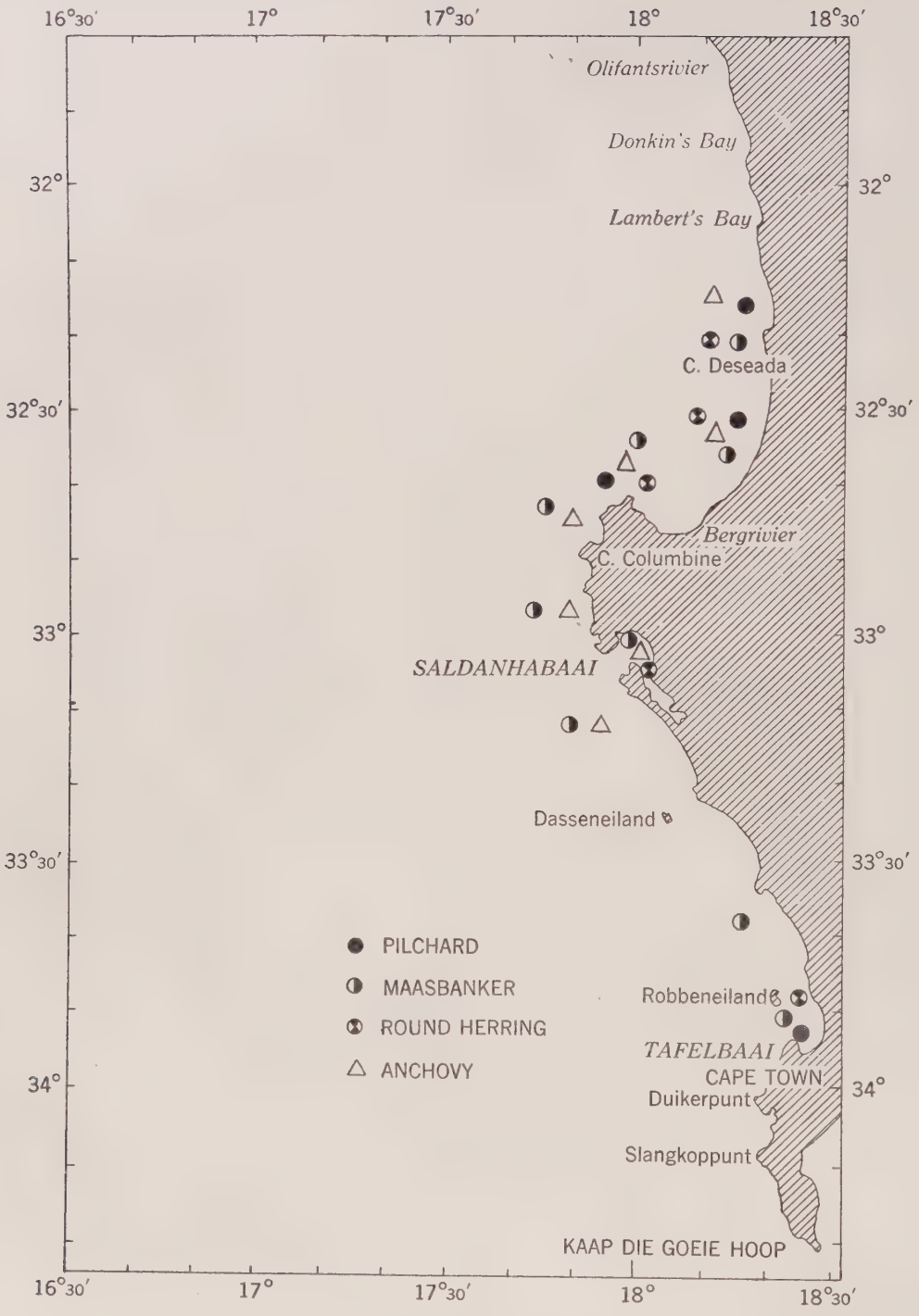
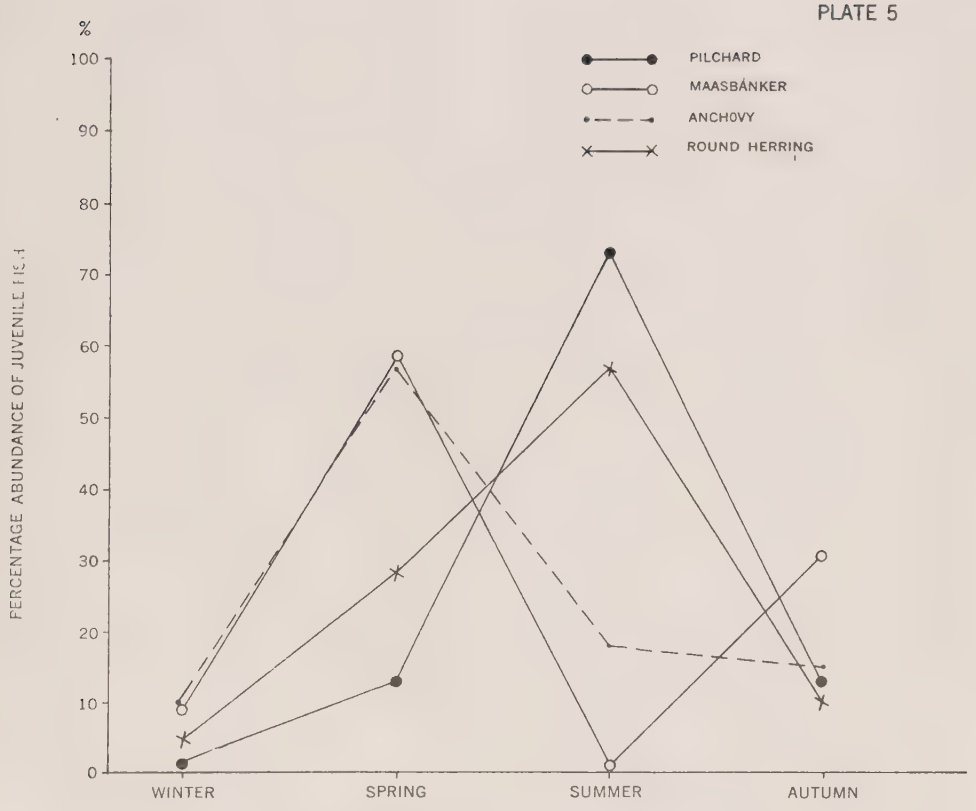


PLATE 4 DISTRIBUTION OF JUVENILE FISH IN AUTUMN, 1956.

Trigsurvey, 1957.

Government, Printer 1957.

PLATE 5



SEASONAL ABUNDANCE OF JUVENILE FISH, 1955-56.

(For actual numbers see Tables 1-4)

Trigsurvey, 1957. Government Printer, 1957.

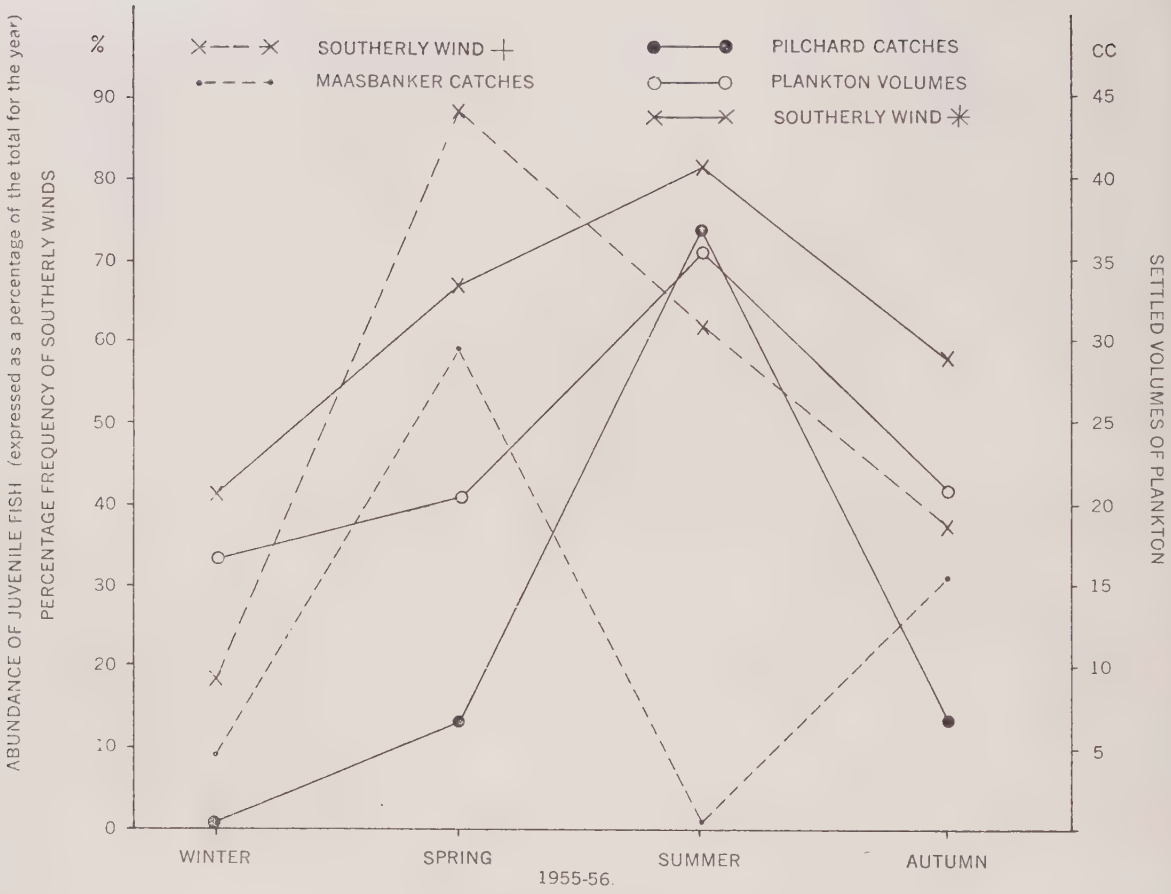


PLATE 6 The Relationship between the Abundance of Juvenile Pilchards and Maasbankers and Southerly Wind and Plankton

✳ Mean seasonal southerly wind based on data collected at Cape Columbine 1939-48 and provided by the Weather Bureau

\+ Mean seasonal southerly wind recorded at blanket-net stations.

Trigsurvey, 1957.

Government Printer 1957.

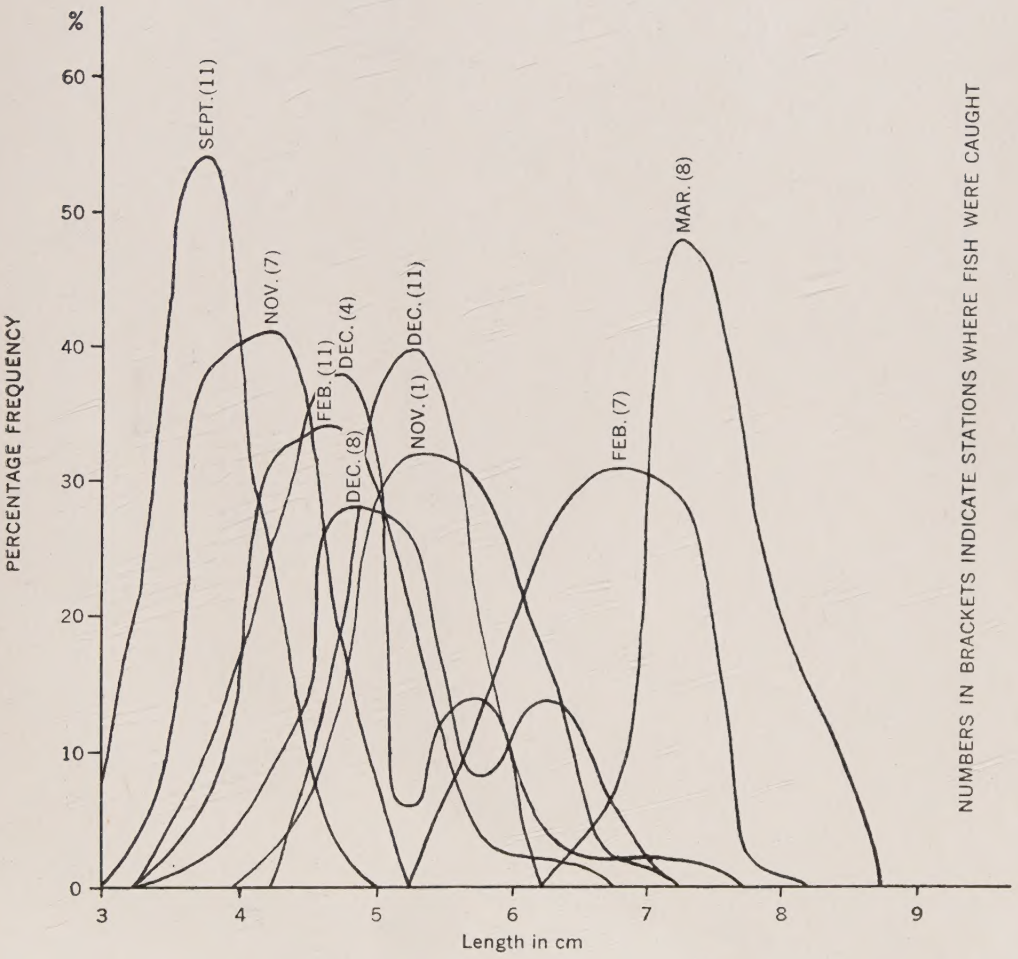


PLATE 7 LENGTH FREQUENCIES OF JUVENILE PILCHARDS CAUGHT AT BLANKET- NET STATIONS, 1955-56.

Government Printer 1957.

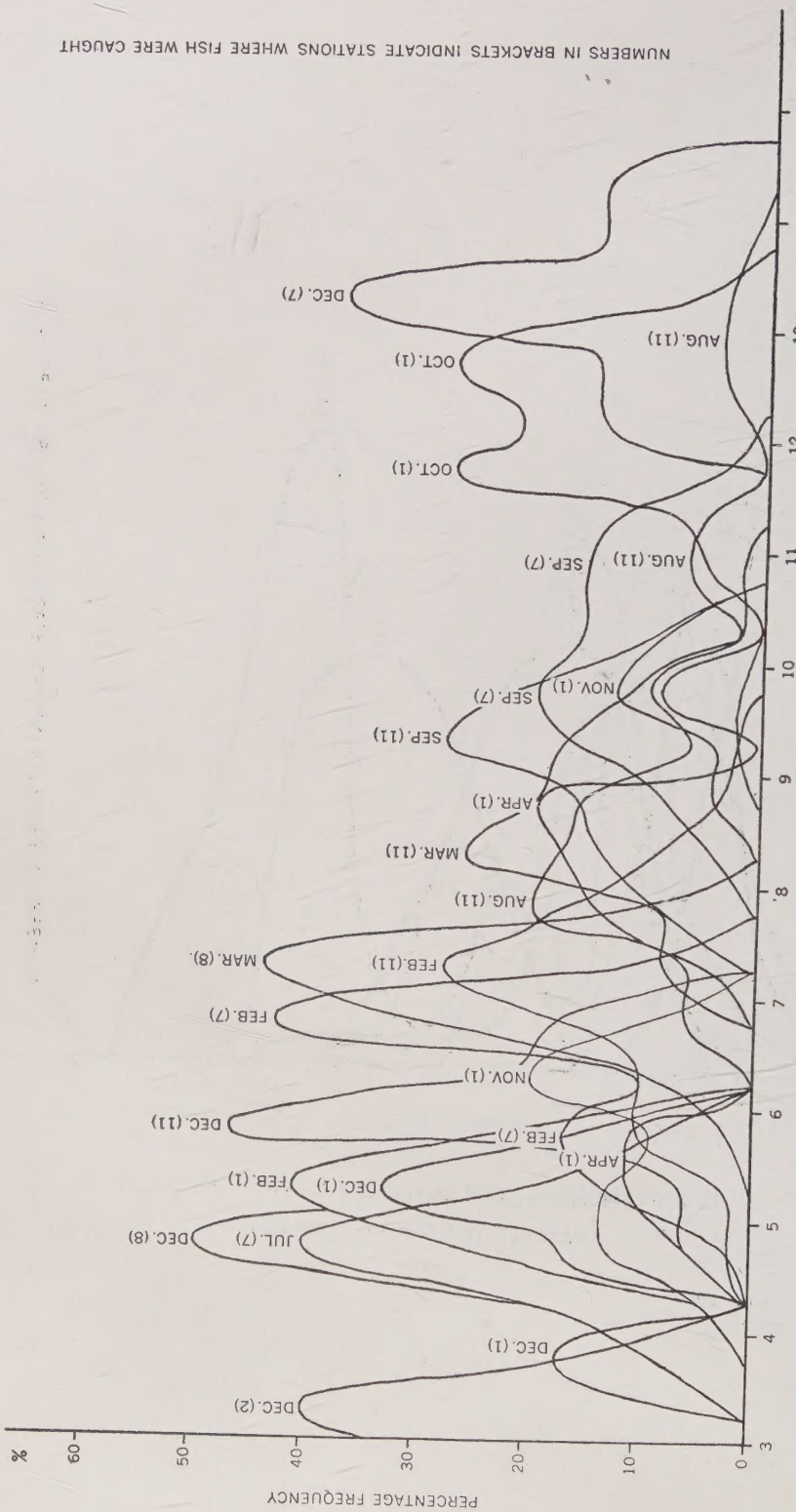


PLATE 8

LENGTH FREQUENCIES OF JUVENILE MAASBANKERS CAUGHT AT BLANKET-NET STATIONS, 1955-56.

Government Printer, 1957.